3GPP TSG-CN *Document*

Plenary Meeting #8, Dusseldorf, Germany

21st – 23rd June 2000.

CHANGE REQUEST

Please see embedded help file at the botto page for instructions on how to fill in this

23.003 CR 022 Current Version:

GSM (AA.BB) or 3G (AA.BBB) specification number ? *? CR number as allocated by MCC support team*

For submission to: CN#08 For approval X stra
list expected approval meeting # here ? for information non-strateg

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM ME X UTRAN / Radio
(at least one should be marked with an X)

Source: N4 Chairman **Date**

Subject: IMEI Formats and Encoding (extract from 22.016 Annex A)

Work item: TEI

Category: F Correction X **Release:**
A Corresponds to a correction in an earlier release
(only one category
B Addition of feature
Shall be marked
C Functional modification of feature
With an X)
D Editorial modification

Reason for change: This CR also moves the Annex A from 22.016 to 23.003, because S1 felt that the Annex is too detailed for S1 specification.

Clauses affected: 6.2.1, New Annex B

Clauses affected:	6.2.1, New Annex B			
Other specs affected:	Other 3G core specifications	X	? List of CRs:	22.016
	Other GSM core specifications		? List of CRs:	
	MS test specifications		? List of CRs:	
	BSS test specifications		? List of CRs:	
	O&M specifications		? List of CRs:	
Other comments:				

help.doc

<--------- double-click here for help and instructions on how to create a CR.

Page 2

6.2.1 Composition of IMEI

The International Mobile station Equipment Identity (IMEI) is composed as shown in figure 10.

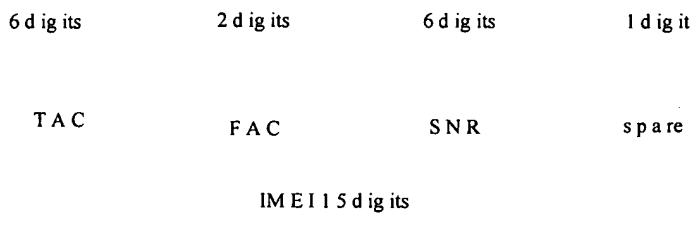

Figure 10: Structure of IMEI

The IMEI is composed of the following elements (each element shall consist of decimal digits only):

- Type Approval Code (TAC). Its length is 6 digits;
- Final Assembly Code (FAC) identifies the place of manufacture/final assembly. Its length is 2 digits;
- Serial Number (SNR) is an individual serial number uniquely identifying each equipment within each TAC and FAC. Its length is 6 digits;
- Spare digit: this digit shall be zero, when transmitted by the MS.

The IMEI (14 digits) is complemented by a check digit. The check digit is not part of the digits transmitted at IMEI check occasions, as described below. The Check Digit shall avoid manual transmission errors, e.g. when customers register stolen MEs at the operators customer care desk. The Check Digit is defined according to the **Luhn formula**, as defined in annex B.

NOTE: The Check Digit is not applied to the Software Version Number.

The security requirements of the IMEI are defined in 3G TS 22.016.

********** NEXT MODIFICATION **********

Annex B (normative):

Annex B (normative):
IMEI Check Digit computation

B.1 Representation of IMEI

The International Mobile station Equipment Identity and Software Version Number (IMEISV), as defined in TS 23.003, is a 16 digit decimal number composed of four distinct elements:

- a 6 digit Type Approval Code (TAC);
- a 2 digit Final Assembly Code (FAC);
- a 6 digit Serial Number (SNR); and
- a 2 digit Software Version Number (SVN).

The IMEISV is formed by concatenating these four elements as illustrated below:

TAC FAC SNR SVN

Figure A.1: Composition of the IMEISV

The IMEI is complemented by a check digit as defined in section 3. The **Luhn** Check Digit (CD) is computed on the 14 most significant digits of the IMEISV, that is on the value obtained by ignoring the SVN digits.

The method for computing the **Luhn** check is defined in Annex B of the International Standard "Identification cards - Numbering system and registration procedure for issuer identifiers" (ISO/IEC 7812) [3].

In order to specify precisely how the CD is computed for the IMEI, it is necessary to label the individual digits of the IMEISV, excluding the SVN. This is done as follows:

The (14 most significant) digits of the IMEISV are labelled D14 D13 ... D1, where:

- TAC = D14 D13 ... D9 (with D9 the least significant digit of TAC);
- FAC = D8 D7 (with D7 the least significant digit of FAC); and
- SNR = D6 D5 ... D1 (with D1 the least significant digit of SNR).

B.2 Computation of CD for an IMEI

Computation of CD from the IMEI proceeds as follows:

Step 1: Double the values of the odd labelled digits D1, D3, D5 ... D13 of the IMEI.

Step 2: Add together the individual digits of all the seven numbers obtained in Step 1, and then add this sum to the sum of all the even labelled digits D2, D4, D6 ... D14 of the IMEI.

Step 3: If the number obtained in Step 2 ends in 0, then set CD to be 0. If the number obtained in Step 2 does not end in 0, then set CD to be that number subtracted from the next higher number which does end in 0.

B.3 Example of computation

IMEI (14 most significant digits):

TAC	FAC	SNR
D14 D13 D12 D11 D10 D9	D8 D7	D6 D5 D4 D3 D2 D1
2 6 0 5 3 1	7 9	3 1 1 3 8 3

Step 1:

2 6 0 5 3 1	7 9	3 1 1 3 8 3
x2 x2 x2	x2	x2 x2 x2
12 10 2	18	2 6 6

Step 2:

2 + 1 + 2 + 0 + 1 + 0 + 3 + 2 + 7 + 1 + 8 + 3 + 2 + 1 + 6 + 8 + 6 = 53

Step 3:

CD = 60 - 53 = 7

Annex B C (informative):
Change history

TSG-RAN Meeting #7 ***RP-000286***
Düsseldorf, Germany, 21 - 23 June 2000

(R3-001649, copy TSG-RAN) Response to LS (S1) on Hexadecimal IMEI format

SOURCE: RAN WG3

TITLE: Response to "Liaison statement on hexadecimal IMEI format"

TO: SA WG1

CC: SA WG5, CN WG1, CN WG4, RAN WG2, RAN WG3, GSM ASSOCIATION, SA WG2, TSG RAN

Contact: jari.isokangas@nokia.com

R3 has approved the change request (attached Tdoc R3-001513) of the RANAP IMEI coding to hexadecimal from present TBCD coding for R99. R3 would like to ask S1 to find out if this change would be appropriate already for R99 with other relevant WG's and co-ordinate the changes between those WG's.

R3 would also like to S1 to inform R3 and TSG RAN if this change is appropriate already for R99 or should this change be scheduled for R00.

3GPP RAN WG3 Meeting #13
Hawaii, USA, 22 – 26 May, 2000

Document R3-001513
e.g. for 3GPP use the format TP-99xxx or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.413 CR 112r1 Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG RAN#8 *list expected approval meeting # here ↑*
for approval [X]
For information [ ]
strategic [ ]
non-strategic [ ]
(for SMG Use only)

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [X] Core Network [X]

Source: Nokia **Date:** 2000-05-23

Subject: Change of the RANAP IMEI coding to hexadecimal from present TBCD

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	[ ]
A	Corresponds to a correction in an earlier release	[ ]
B	Addition of feature	[ ]
C	Functional modification of feature	[X]
D	Editorial modification	[ ]

Release:

Phase 2	[ ]
Release 96	[ ]
Release 97	[ ]
Release 98	[ ]
Release 99	[X]
Release 00	[ ]

Reason for change:

The current IMEI message structure is proposed to be changed to allow use of hexadecimal coding in addition of current BCD. The change is proposed in 3GPP TSG-CN,TSG-S, TSG-T and TSG-R to allow 16.7 million mobile terminals to be produced with one Type Approval Code. The current restriction for one million units per TAC is already a problem in the GSM terminal manufacturing and can only be predicted to worsen in the future.
Change to use hexadecimal coding is most simple since it does not affect to existing message lengths in GSM air interface and network interfaces.
In case of RAN WG3, the change is only required to the CN Invoke Trace message information element 'UE Identity', IMEI is used for those UE's that have active emergency call without or with a defective USIM module. The change does not affect to message/information element length since BCD (actually TBCD in ASN.1 definition) and hexadecimal digit coding consume equal amount of bits. In the TS25.413 Iu interface RANAP protocol (and generally in MAP protocol), the only issue is to not use any 'sanity' check for this information element and allow all 4-bit binary values for all 15 digits of IMEI. The old IMEI coding in GSM system is fully backwards compatible with the changed coding for the message interface. (Depending on CN implementation it may be necessary to change the IMEI database control software. Note that in the MAP protocol the TBCD coding has been used for IMEI – in practise currently the coding is BCD, since IMEI is not using any of the special TBCD values ['*'=1010, '#'=1011, 'a'=1100, 'b'=1101, 'c'=1110])
The TBCD coding in MAP/RANAP for IMEI is technically only ruling out the use of code 'F' for the IMEI digits, this highlights further how small change in the

message interface we are actually discussing.

Clauses affected: Clauses 9.2.1.9 and corresponding ASN.1 IE definition 9.3.4

Other specs Affected:	Other 3G core specifications	X	→ List of CRs: 25.331, 23.003, 22.016
	Other GSM core specifications	X	→ List of CRs: 03.03, 04.08
	MS test specifications		→ List of CRs:
	BSS test specifications		→ List of CRs:
	O&M specifications		→ List of CRs:

Other comments:


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1.1.1.1 9.2.1.9 UE Identity

This element identifies the element to be traced i.e. the subscriber or the user equipment.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Choice **UE Identity**				
>IMSI			OCTET STRING (SIZE (3..8))	- digits 0 to 9, two digits per octet, - each digit encoded 0000 to 1001, - 1111 used as filler - bit 4 to 1 of octet n encoding digit 2n-1 - bit 8 to 5 of octet n encoding digit 2n -Number of decimal digits shall be from 6 to 15 starting with the digits from the PLMN-ID.
>IMEI			OCTET STRING (SIZE (8))	- hexadecimal digits 0 to F~~9~~, two hexadecimal digits per octet, - each hexadecimal digit encoded 0000 to 111~~00~~1, - 1111 used as filler for bits 8 to 5 of last octet - bit 4 to 1 of octet n encoding digit 2n-1 - bit 8 to 5 of octet n encoding digit 2n Number of hexadecimal digits shall be 15.

******** **NEXT MODIFIED SECTION** ********

9.3.4 Information Element Definitions

****** LOTS OF UNAFFECTED ASN.1 DESCRIPTION FROM SECTION 9.3.4 REMOVED ******

```
-- I

IMEI                    ::= ~~TBCD~~ OCTET STRING (SIZE (8))
-- Reference: 23.003
```

****** LOTS OF UNAFFECTED ASN.1 DESCRIPTION FROM SECTION 9.3.4 REMOVED ******

3GPP TSG-CN
Plenary Meeting #8, Dusseldorf, Germany
21st – 23rd June 2000

Document NP-000373
e.g. for 3GPP use the format TP-99xxx or for SMG, use the format P-99-xxx

CHANGE REQUEST

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23.003 CR 022 Current Version: 3.4.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: CN#08 *list expected approval meeting # here ↑*
For approval [X] for information [ ]
strategic [ ] non-strategic [X] *(for SMG use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [X] UTRAN / Radio [ ] Core Network [X]

Source: N4 Chairman **Date:** 22.06.00

Subject: IMEI Formats and Encoding (extract from 22.016 Annex A)

Work item: TEI

Category: *(only one category Shall be marked With an X)*

F	Correction	[X]	**Release:**	Phase 2	[ ]
A	Corresponds to a correction in an earlier release	[ ]		Release 96	[ ]
B	Addition of feature	[ ]		Release 97	[ ]
C	Functional modification of feature	[ ]		Release 98	[ ]
D	Editorial modification	[ ]		Release 99	[X]
				Release 00	[ ]

Reason for change: This CR also moves the Annex A from 22.016 to 23.003, because S1 felt that the Annex is too detailed for S1 specification.

Clauses affected: 6.2.1, New Annex B

Other specs affected:

Other 3G core specifications	[X]	→ List of CRs: 22.016
Other GSM core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments:

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<--------- double-click here for help and instructions on how to create a CR.

6.2.1 Composition of IMEI

The International Mobile station Equipment Identity (IMEI) is composed as shown in figure 10.

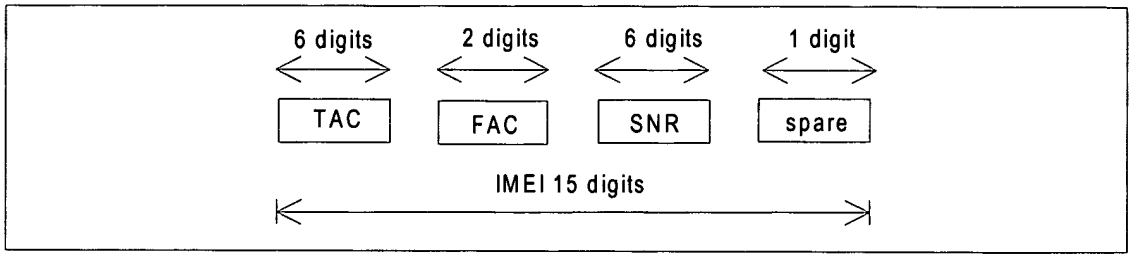

Figure 10: Structure of IMEI

The IMEI is composed of the following elements (each element shall consist of decimal digits only):

- Type Approval Code (TAC). Its length is 6 digits;
- Final Assembly Code (FAC) identifies the place of manufacture/final assembly. Its length is 2 digits;
- Serial Number (SNR) is an individual serial number uniquely identifying each equipment within each TAC and FAC. Its length is 6 digits;
- Spare digit: this digit shall be zero, when transmitted by the MS.

The IMEI (14 digits) is complemented by a check digit. The check digit is not part of the digits transmitted at IMEI check occasions, as described below. The Check Digit shall avoid manual transmission errors, e.g. when customers register stolen MEs at the operators customer care desk. The Check Digit is defined according to the Luhn formula, as defined in annex B.

NOTE: The Check Digit is not applied to the Software Version Number.

The security requirements of the IMEI are defined in 3G TS 22.016.

********** NEXT MODIFICATION **********

Annex B (normative): IMEI Check Digit computation

B.1 Representation of IMEI

The International Mobile station Equipment Identity and Software Version Number (IMEISV), as defined in TS 23.003, is a 16 digit decimal number composed of four distinct elements:

- a 6 digit Type Approval Code (TAC);
- a 2 digit Final Assembly Code (FAC);
- a 6 digit Serial Number (SNR); and
- a 2 digit Software Version Number (SVN).

The IMEISV is formed by concatenating these four elements as illustrated below:

Figure A.1: Composition of the IMEISV

The IMEI is complemented by a check digit as defined in section 3. The Luhn Check Digit (CD) is computed on the 14 most significant digits of the IMEISV, that is on the value obtained by ignoring the SVN digits.

The method for computing the Luhn check is defined in Annex B of the International Standard "Identification cards - Numbering system and registration procedure for issuer identifiers" (ISO/IEC 7812) [3].

In order to specify precisely how the CD is computed for the IMEI, it is necessary to label the individual digits of the IMEISV, excluding the SVN. This is done as follows:

The (14 most significant) digits of the IMEISV are labelled D14 D13 ... D1, where:

- TAC = D14 D13 ... D9 (with D9 the least significant digit of TAC);
- FAC = D8 D7 (with D7 the least significant digit of FAC); and
- SNR = D6 D5 ... D1 (with D1 the least significant digit of SNR).

B.2 Computation of CD for an IMEI

Computation of CD from the IMEI proceeds as follows:

Step 1: Double the values of the odd labelled digits D1, D3, D5 ... D13 of the IMEI.

Step 2: Add together the individual digits of all the seven numbers obtained in Step 1, and then add this sum to the sum of all the even labelled digits D2, D4, D6 ... D14 of the IMEI.

Step 3: If the number obtained in Step 2 ends in 0, then set CD to be 0. If the number obtained in Step 2 does not end in 0, then set CD to be that number subtracted from the next higher number which does end in 0.

B.3 Example of computation

IMEI (14 most significant digits):

TAC						FAC		SNR					
D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1
2	6	0	5	3	1	7	9	3	1	1	3	8	3

Step 1:

2	6	0	5	3	1	7	9	3	1	1	3	8	3
	x2		x2		x2		x2		x2		x2		x2
	12		10		2		18		2		6		6

Step 2:

2 + 1 + 2 + 0 + 1 + 0 + 3 + 2 + 7 + 1 + 8 + 3 + 2 + 1 + 6 + 8 + 6 = 53

Step 3:

CD = 60 - 53 = 7

Annex ~~B~~ C (informative):
Change history

3GPP TSG-SA, WG1 meeting #8 TDoc S1#8 (00)0275

Peking, China, April 10-15, 2000

Source: Nokia

Title: Proposal to modify IMEI format

Background

The current IMEI format is structured in the following way:

- Type Approval Code (TAC): 6 digits. The first 2 digits constitute the code allocated to Notified Body = Reporting Body Identifier(1900 MHz phones in USA and test terminals have different coding)
- Final Assembly Code (FAC): 2 digits
- Serial Number: 6 digits
- Check digit

These digits have been presented in BCD format. New Type Approval Codes have been issued with a 6 BCD digits Serial Number set (1Million units) is not sufficient any more. This format has served well and no problems have been envisaged as far as an unambiguous terminal coding for GSM is concerned. However, the introduction of the IMEI into 3G mobile terminal identification changes the situation as soon as a great variety of products manufactured in larger volumes will flow to market place. Nevertheless, any modification in the IMEI coding must not jeopardize smooth migration from one mobile generation to the next one.

Proposal

Given the strong reliance on the interoperability with legacy products no change to IMEI length or structure is considered feasible. In contrast, the coding format of the Serial Number is proposed to be modified.

- Instead using BCD, a hexadecimal code format is proposed. It would offer a capacity of

16.7 Million units manufactured with one Type Approval Code.
- TAC would set a trigger for interpretation (Network would identify from which TAC number onwards a serial number would be interpreted as binary presentation)

This proposal will require modifications to network management system for both installed and new (GSM and 3G). But no modifications to existing Rel '99 signalling is foreseen.

Change of coding is proposed for release 2000. However, change should be considered already for release 1999 in order to allow new IME coding in all 3G terminals.

Attached CR to 22.016 for Release 2000.

3GPP SA

CHANGE REQUEST

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22.016CR

Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number

CR number as allocated by MCC support team

For submission to: TSG#8	for approval X	strategic	(for
list expected approval meeting # here	for information	non-strategic	use

Form: CR cover sheet, version 2 for 3GPP and SMG

The latest version of this form is available from: ftp://ftp.3gpp.org/Inform Fo

Proposed change affects: (U)SIM ME x UTRAN / Radio Core Netw
(at least one should be marked with an X)

Source: Nokia Date: 10/4/00

Subject: IMEI coding

Work item:

Category:	F Correction		Release: Phase 2
	A Corresponds to a correction in an earlier release		Release 9€
(only one category	B Addition of feature		Release 9ᵀ
shall be marked	C Functional modification of feature	X	Release 9€
with an X)	D Editorial modification		Release 9ᵍ
			Release 0(

Reason for change:	Change of IMEI coding from decimal format to hexadecimal.	
Clauses affected:	Annex A:	
Other specs affected:	Other 3G core specifications	→ List of CRs:
	Other GSM core specifications	→ List of CRs:
	MS test specifications	→ List of CRs:
	BSS test specifications	→ List of CRs:
	O&M specifications	→ List of CRs:
Other comments:		

<--------- double-click here for help and instructions on how to create a CR.

Annex A (normative): IMEI Check Digit computation

A.1 Representation of IMEI

The International Mobile station Equipment Identity and Software Version Number (IMEISV), as defined in TS 23.003, is a **16** digit hexadecimal number composed of four distinct elements:

- a 6 digit Type Approval Code (TAC);

- a 2 digit Final Assembly Code (FAC);

- a 6 digit Serial Number (SNR); and

- a 2 digit Software Version Number (SVN).

The IMEISV is formed by concatenating these four elements as illustrated below:

Figure A.1: Composition of the IMEISV

The IMEI is complemented by a check digit as defined in section 3. The **modulus 16 Luhn** Check Digit (CD) is computed on the 14 most significant hexadecimal digits of the IMEISV, that is on the value obtained by ignoring the SVN digits.

The method for computing the **Luhn** check is defined in Annex B of the International Standard "Identification cards -

Numbering system and registration procedure for issuer identifiers" (ISO/IEC 7812) [3]. The **modulus 16 Luhn** Check Digit is identical, but number base has been transformed from 10 to **16**.

In order to specify precisely how the CD is computed for the IMEI, it is necessary to label the individual digits of the IMEISV, excluding the SVN. This is done as follows:

The (14 most significant) digits of the IMEISV are labelled D14 D13 ... D1, where:

- TAC = D14 D13 ... D9 (with D9 the least significant digit of TAC);

- FAC = D8 D7 (with D7 the least significant digit of FAC); and

- SNR = D6 D5 ... D1 (with D1 the least significant digit of SNR).

Note: Even though all digits D1□ D14 are changed to use hexadecimal coding, this has no effect to the previously assigned values of all fields when the fields were using BCD coding. The same code values can still be used for the previously assigned codes. The hexadecimal coding allows more codes to be used for all fields. Especially this applies to the SNR field, which has number space of 2^24 = 16,777,216 units □ with BCD coding the number space is 1,000,000 units.

A.2 Computation of CD for an IMEI

Computation of CD from the IMEI proceeds as follows:

Step 1: Double the values of the odd labelled digits H1, H3, H5, ... H13 of the IMEI using hexadecimal number base.

Step 2: Add together the individual digits of all the seven numbers obtained in Step 1, and then add this sum to the sum of all the even labelled digits H2, H4, H6, ... H14 of the IMEI using hexadecimal number base.

Step 3: If the number obtained in Step 2 ends in 0, then set CD to be 0. If the number obtained in Step 2 does not end in 0, then set CD to be that number subtracted from the next higher hexadecimal number which does end in 0.

A.3 Example of computation

IMEI (14 most significant digits):

TAC	FAC	SNR
H14 H13 H12 H11 H10 H9	H8 H7	H6 H5 H4 H3 H2 H1
2 6 0 5 3 1	7 9	3 8 D 3 E 3

Step 1:

2 6 0 5 3 1	7 9	3 8 D 3 E 3
x2 x2 x2	x2	x2 x2 x2
C A 2	12	10 6 6

Step 2:

2 + C + 0 + A + 3 + 2 + 7 + 1 + 2 + 3 + 1 + 0 + D + 6 + E + 6 = 52

Step 3:

CD = 60 - 52 = E

3GPP TSG-SA, WG1 meeting #8
Peking, China, April 10-15, 2000

TDoc S1#8 (00)0275

Source: **Nokia**

Title: Proposal to modify IMEI format

Background

The current IMEI format is structured in the following way:

- Type Approval Code (TAC): 6 digits. The first 2 digits constitute the code allocated to Notified Body = Reporting Body Identifier(1900 MHz phones in USA and test terminals have different coding)
- Final Assembly Code (FAC): 2 digits
- Serial Number: 6 digits
- Check digit

These digits have been presented in BCD format. New Type Approval Codes have been issued with a 6 BCD digits Serial Number set (1Million units) is not sufficient any more. This format has served well and no problems have been envisaged as far as an unambiguous terminal coding for GSM is concerned. However, the introduction of the IMEI into 3G mobile terminal identification changes the situation as soon as a great variety of products manufactured in larger volumes will flow to market place. Nevertheless, any modification in the IMEI coding must not jeopardize smooth migration from one mobile generation to the next one.

Proposal

Given the strong reliance on the interoperability with legacy products no change to IMEI length or structure is considered feasible. In contrast, the coding format of the Serial Number is proposed to be modified.

- Instead using BCD, a hexadecimal code format is proposed. It would offer a capacity of 16.7 Million units manufactured with one Type Approval Code.
- TAC would set a trigger for interpretation (Network would identify from which TAC number onwards a serial number would be interpreted as binary presentation)

This proposal will require modifications to network management system for both installed and new (GSM and 3G). But no modifications to existing Rel '99 signalling is foreseen.

Change of coding is proposed for release 2000. However, change should be considered already for release 1999 in order to allow new IME coding in all 3G terminals.

Attached CR to 22.016 for Release 2000.

CHANGE REQUEST

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22.016 CR

Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑

↑ CR number as allocated by MCC support team

For submission to: TSG#8 *list expected approval meeting # here ↑*	for approval [X]	strategic [ ] *(for SMG use only)*
	for information [ ]	non-strategic [ ]

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [X] UTRAN / Radio [ ] Core Network [X]

Source: Nokia **Date:** 10/4/00

Subject: IMEI coding

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	[ ]	**Release:** Phase 2	[ ]
A	Corresponds to a correction in an earlier release	[ ]	Release 96	[ ]
B	Addition of feature	[ ]	Release 97	[ ]
C	Functional modification of feature	[X]	Release 98	[ ]
D	Editorial modification	[ ]	Release 99	[ ]
			Release 00	[X]

Reason for change: Change of IMEI coding from decimal format to hexadecimal.

Clauses affected: Annex A:

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

Annex A (normative): IMEI Check Digit computation

A.1 Representation of IMEI

The International Mobile station Equipment Identity and Software Version Number (IMEISV), as defined in TS 23.003, is a 16 digit hexadecimal number composed of four distinct elements:

- a 6 digit Type Approval Code (TAC);
- a 2 digit Final Assembly Code (FAC);
- a 6 digit Serial Number (SNR); and
- a 2 digit Software Version Number (SVN).

The IMEISV is formed by concatenating these four elements as illustrated below:

Figure A.1: Composition of the IMEISV

The IMEI is complemented by a check digit as defined in section 3. The modulus 16 Luhn Check Digit (CD) is computed on the 14 most significant hexadecimal digits of the IMEISV, that is on the value obtained by ignoring the SVN digits.
The method for computing the Luhn check is defined in Annex B of the International Standard "Identification cards - Numbering system and registration procedure for issuer identifiers" (ISO/IEC 7812) [3]. The modulus 16 Luhn Check Digit is identical, but number base has been transformed from 10 to 16.
In order to specify precisely how the CD is computed for the IMEI, it is necessary to label the individual digits of the IMEISV, excluding the SVN. This is done as follows:
The (14 most significant) digits of the IMEISV are labelled D14 D13 ... D1, where:

- TAC = D14 D13 ... D9 (with D9 the least significant digit of TAC);
- FAC = D8 D7 (with D7 the least significant digit of FAC); and
- SNR = D6 D5 ... D1 (with D1 the least significant digit of SNR).

Note: Even though all digits D1... D14 are changed to use hexadecimal coding, this has no effect to the previously assigned values of all fields when the fields were using BCD coding. The same code values can still be used for the previously assigned codes. The hexadecimal coding allows more codes to be used for all fields. Especially this applies to the SNR field, which has number space of 2^24 = 16,777,216 units – with BCD coding the number space is 1,000,000 units.

A.2 Computation of CD for an IMEI

Computation of CD from the IMEI proceeds as follows:

Step 1: Double the values of the odd labelled digits HĐ1, HĐ3, HĐ5, ... HĐ13 of the IMEI using hexadecimal number base.

Step 2: Add together the individual digits of all the seven numbers obtained in Step 1, and then add this sum to the sum of all the even labelled digits HĐ2, HĐ4, HĐ6, ... HĐ14 of the IMEI using hexadecimal number base.

Step 3: If the number obtained in Step 2 ends in 0, then set CD to be 0. If the number obtained in Step 2 does not end in 0, then set CD to be that number subtracted from the next higher hexadecimal number which does end in 0.

A.3 Example of computation

IMEI (14 most significant digits):

TAC						FAC		SNR					
HD14	HD13	HD12	HD11	HD10	HD9	HD8	HD7	HD6	HD5	HD4	HD3	HD2	HD1
2	6	0	5	3	1	7	9	3	81	D1	3	E8	3

Step 1:

2	6	0	5	3	1	7	9	3	81	D1	3	E8	3
	x2		x2		x2		x2		x2		x2		x2
	C12		A10		2		128		102		6		6

Step 2:

2 + C1 + 2 + 0 + A1 + 0 + 3 + 2 + 7 + 1 + 28 + 3 + 1 + 02 + D1 + 6 + E8 + 6 = 5253

Step 3:

CD = 60 - 523 = E7